REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-27 are pending in this application. Claims 1, 2, 6, 12-16, 20, 26 and 27 are amended by the present amendment, without adding new matter.

In the outstanding Office Action, Claim 27 was rejected under 35 U.S.C. § 101; Claims 1-9, 11-13, 15-23, and 25-27 were rejected under 35 U.S.C. § 102(e) as anticipated by U.S. Patent 6,574,595 to Mitchell et al. (herein "Mitchell"); Claims 10 and 24 were rejected under 35 U.S.C. § 103(a) as unpatentable over Mitchell in view of U.S. Publication 2002/0178004 to Chang et al. (herein "Chang"); and Claim 14 was rejected under 35 U.S.C. § 103(a) as unpatentable over Mitchell in view of U.S. Patent 5,857,169 to Seide.

Regarding the rejection under 35 U.S.C. § 101, Claim 27 is amended to be directed to a computer-readable medium. Applicants respectfully submit that such a computer-readable medium is patentable subject matter within the scope of 35 U.S.C. § 101. Thus, it is respectfully requested that rejection be withdrawn.

Further, Applicants respectfully traverse the rejection of Claims 1-9, 11-13, 15-23, and 25-27 under 35 U.S.C. § 102(e) as anticipated by Mitchell.

Applicants have discovered an improvement over background token passing algorithms. Such background token passing algorithms can be thought of as using tokens that are associated with a node in a decoding network and represent the best partial path from the start node up to a corresponding node. Each token is a (logical) data structure, is stored in memory, and is associated with a text unit or word history corresponding to the best partial path leading to the corresponding node. The tokens also comprise a likelihood "score" for the word history."[1]

[1] Specification at page 3, lines 8-12.

In other words, in the background algorithms, each token includes a text unit or word history corresponding to the best partial path and a likelihood "score" for the corresponding word history. Each token in the background algorithms may be created using word histories and scores from N previous tokens in a process known as token merging.[2] A background token merging process may require the following steps:

1. Establish space for storing the new token making sure the correct state number is stored or is implicit from the token.

2. Calculate emission and transition log likelihood for new state and add to top log likelihood.

3. Select entries for new token from the best of the existing tokens, in which case the offset doesn't change, or from any other token in which case the offset is adjusted to be an offset to the new highest log likelihood.

4. For efficiency reasons, it is normal to make sure the entries of the new token are in a sorted order.

However, Applicants have discovered that the last two steps in the background merging algorithm (i.e., steps 3 and 4 above) are particularly time consuming since they involve selecting the particular entries in the previous tokens and pruning the entries.[3]

Claim 1 is directed to a decoder for an automatic speech recognition system for determining one or more candidate text unit concatenations according to a predetermined criterion and which correspond to a speech segment. The decoder includes, in part, a processor arranged to receive a sequence of feature vectors corresponding to the speech segment. The processor is arranged to map with different likelihood values the feature vectors to sequences of nodes in a decoding network, every sequence representing a concatenation of text units. The processor is also arranged to determine one or more

[2] Specification at page 19, lines 11-15.
[3] Specification at page 23, last two lines.

candidate node sequences in the decoding network corresponding to the candidate text unit concatenations by implementing a dynamic programming token passing algorithm in which each token corresponds to a node and is associated with a number of text unit concatenations and likelihood values for these concatenations. A token associated with a node in the decoding network is derived from the tokens associated with the previous nodes in the network, and tokens from different nodes that are to be passed to a common node are combined to generate a new token corresponding to the common node and associated with an identifier for text unit concatenations and likelihood values associated with the previous tokens of said different nodes. Further, a merging of the text unit concatenations is delayed based on the likelihood values. Independent Claims 13-15, 26, and 27 include similar features directed to an automatic speech recognition system, a voice activated control or navigation system for in car use, a method of decoding, a method of automatically recognizing speech, and a computer readable medium, respectively.

Thus, the inventions of the independent claims advantageously avoid delays caused by steps 3 and 4 described above.

Applicants Figure 10 shows a block diagram of a non-limiting embodiment of a process according to the independent claims, which may be implemented using the non-limiting embodiment of a decoder in Applicants Figure 1. According to this example, a token is used which has a likelihood value and an identifier for text unit concatenations. Thus, in the claimed inventions, the token includes ***the identifier*** for text unit concatenations, which replaces the word history utilized in background algorithms.

For example, according to a background merging algorithm as shown in Applicants' Figure 9, the generation of token state 5 includes the combining of token states 2 and 3, which requires the word histories for each node to be calculated on a frame by frame basis.

On the other hand, in the non-limiting embodiment of the claimed inventions in Applicants' Figure 10, the token associated with state 5 is produced from the tokens of states 2 and 3. The top log likelihood is calculated and an entry is an identifier to list C. C contains A+B (to be evaluated). A and B are the word history structures of states 2 and 3, respectively. However, A+B is not calculated at this stage to produce C. This is in contrast to the algorithm of the background method where generation of the token of state 5 requires the combination of states 2 and 3. Thus, in the claimed inventions, the word histories for each node do not have to be calculated on a frame by frame basis, and instead, the merged word histories are determined when the end node is reached.

Therefore, the present invention allows the merge operation (determining the word histories to associate with the new token) to be delayed or carried out later, for example when the network processing is halted. Accordingly, a process or apparatus according to the claimed inventions may advantageously avoid a merging operation associated with tokens which are later discovered to be highly unlikely and so not amongst the N-best.[4]

Applicants respectfully submit that Mitchell fails to teach or suggest each of the features of independent Claims 1, 13-15, 26, and 27. For example, it is respectfully submitted that Mitchell fails to teach or suggest a token passing algorithm in which each token is associated with a number of text unit concatenations and likelihood values for these concatenations, and combining the tokens from plural different nodes to generate a new token associated with a new node, without necessarily combining the candidate text unit concatenations.

Mitchell describes a method and apparatus for automatic speech recognition that includes a "barge-in" step 232 for rapidly stopping a prompt to improve recognition and

[4] Specification at page 5, lines 11-16.

reduce speaker confusion.[5] According to Mitchell, the automatic speech recognition is performed on a sub-word level to declare a "barge-in" when a maximum number of phonemes is reached.[6] In particular, Mitchell indicates that in step 208, likelihood scores are compiled, and in step 210, a sub-word network of possible sub-word sequences are built, before moving on to a next phoneme.[7] In other words, Mitchell calculates a sub-word sequence (e.g., merged text units) on a frame by frame basis and thus there is no disclosure or suggestion of an identifier which allows the merge operation of text units to be delayed based on a likelihood value.

Accordingly, it is respectfully submitted that Mitchell fails to teach or suggest each of the features of independent Claims 1, 13-15, 26, and 27. Thus, it is respectfully submitted that independent Claims 1, 13-15, 26, and 27, and claims depending therefrom, patentably define over Mitchell.

Accordingly, it is respectfully requested the rejection of Claims 1-9, 11-13, 15-23, and 25-27 under 35 U.S.C. § 102(e) be withdrawn.

In addition, Applicants respectfully traverse the rejections of Claims 10 and 14 as unpatentable over Mitchell in view of Chang or Seide, respectively. Claim 10 depends from Claim 1, and Claims 1 and 14 are believed to patentably define over Mitchell, as discussed above. Further, Applicants respectfully submit that Chang and Seide fail to supply the claimed features lacking in the disclosure of Mitchell. Thus, it is respectfully requested those rejections also be withdrawn.

Accordingly, Applicants respectfully submit that independent Claims 1, 13-15, 26, and 27, and claims depending therefrom, are allowable.

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[5] Mitchell at Abstract and FIG. 2B.
[6] Mitchell at column 1, lines 60-64.
[7] Mitchell at column 5, lines 54-61, and column 6, lines 51-59.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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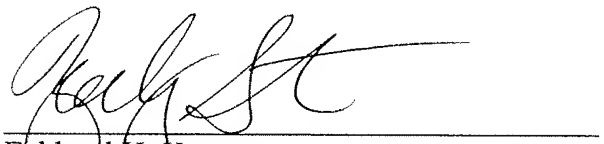

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